

10/527901

Rec'd PCT/PTO 14 MAR 2005

PCT/SG 03 / 00 17 8

REGISTRY OF PATENTS  
SINGAPORE

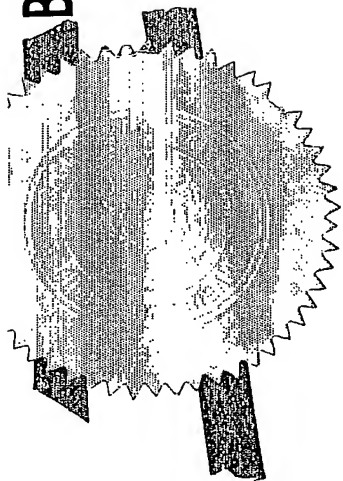
REC'D 11 AUG 2003

WIPO PCT

This is to certify that the annexed is a true copy of the following Singapore patent application as filed in this Registry.

Date of Filing : 13 SEPTEMBER 2002 (13-09-2002)  
Application number : 200205517-6  
Applicants : DEFENCE SCIENCE & TECHNOLOGY AGENCY  
Title of Invention : A SYSTEM FOR CONNECTING BUOYANT MARINE BODIES

BEST AVAILABLE COPY



*Chen*

Serene Chan (Miss)  
Assistant Registrar  
For Registrar of Patents  
Singapore

05 August 2003

**PRIORITY DOCUMENT**  
SUBMITTED OR TRANSMITTED IN  
COMPLIANCE WITH  
RULE 17.1(a) OR (b)

**PRIORITY DOCUMENT**  
SUBMITTED OR TRANSMITTED IN  
COMPLIANCE WITH  
RULE 17.1(a) OR (b)

INTELLECTUAL PROPERTY OFFICE OF SINGAPORE  
REQUEST FOR THE GRANT OF A PATENT UNDER  
SECTION 25

101101

\* denotes mandatory fields

1. YOUR REFERENCE\*

MJ/JOL/aa/PAT/8110629/SG

2. TITLE OF  
INVENTION\*

A SYSTEM FOR CONNECTING BUOYANT MARINE BODIES

3. DETAILS OF APPLICANT(S)\* (see note 3)

Number of applicant(s)

01

(A) Name

DEFENCE SCIENCE & TECHNOLOGY AGENCY

Address

1 DEPOT ROAD,  
#03-01J, DEFENCE TECHNOLOGY TOWERS,  
SINGAPORE 109679

State

Country

SG

☒

For corporate applicant

☐

For individual applicant

State of incorporation

State of residency

Country of incorporation

SINGAPORE

Country of residency

☐

For others (please specify in the box provided below)

(B) Name

Address

State

Country

☐ For corporate applicant

☐ For individual applicant

State of incorporation

State of residency

Country of incorporation

Country of residency

☐ For others (please specify in the box provided below)

(C) Name

Address

State

Country

☐ For corporate applicant

☐ For individual applicant

State of incorporation

State of residency

Country of incorporation

Country of residency

☐ For others (please specify in the box provided below)

☐

Further applicants are to be indicated on continuation sheet 1

#### 4. DECLARATION OF PRIORITY (see note 5)

A. Country/country designated

File number

Filing Date

DD MM YYYY

B. Country/country designated

File number

Filing Date

DD MM YYYY

☐

Further details are to be indicated on continuation sheet 6

#### 5. INVENTOR(S)\* (see note 6)

A. The applicant(s) is/are the sole/joint inventor(s)

Yes

☐

No

☒

200205517-6

B. A statement on Patents Form 8 is/will be furnished

Yes

☒

No

☐

6. CLAIMING AN EARLIER FILING DATE UNDER (see note 7)

☐

section 20(3)

☐

section 26(6)

☐

section 47(4)

Patent application number

DD MM YYYY

Filing Date

Please mark with a cross in the relevant checkbox provided below  
(Note: Only one checkbox may be crossed.)

☐

Proceedings under rule 27(1)(a)

DD MM YYYY

Date on which the earlier application was amended

☐

Proceedings under rule 27(1)(b)

7. SECTION 14(4)(C) REQUIREMENTS (see note 8)

Invention has been displayed at an international exhibition. Yes

☐

No

☒

8. SECTION 114 REQUIREMENTS (see note 9)

The invention relates to and/or used a micro-organism deposited for the purposes of disclosure in accordance with section 114 with a depository authority under the Budapest Treaty.

Yes

☐

No

☒

9. CHECKLIST\*

(A) The application consists of the following number of sheets

i.	Request	<input type="text" value="5"/>	Sheets
ii.	Description	<input type="text" value="15"/>	Sheets
iii.	Claim(s)	<input type="text" value="7"/>	Sheets
iv.	Drawing(s)	<input type="text" value="4"/>	Sheets
v.	Abstract (Note: The figure of the drawing, if any, should accompany the abstract)	<input type="text" value="1"/>	Sheets
Total number of sheets		<input type="text" value="32"/>	Sheets

(B) The application as filed is accompanied by:

☐

Priority document(s)

☐

Translation of priority document(s)

☒

Statement of inventorship  
& right to grant

☐

International exhibition certificate

**10. DETAILS OF AGENT (see notes 10, 11 and 12)**

Name

Firm

DREW & NAPIER LLC

**11. ADDRESS FOR SERVICE IN SINGAPORE\* (see note 10)**

Block/Hse No.

Level No.

Unit No./PO Box

152

Street Name

ROBINSON ROAD

Building Name

Postal Code

900302

**12. NAME, SIGNATURE AND DECLARATION (WHERE APPROPRIATE) OF APPLICANT OR AGENT\* (see note 12)**  
(Note: Please cross the box below where appropriate.)

☒

I, the undersigned, do hereby declare that I have been duly authorised to act as representative, for the purposes of this application, on behalf of the applicant(s) named in paragraph 3 herein.

Name and Signature  
(DREW & NAPIER LLC)

DD MM YYYY

12 09 2002

## NOTES:

1. This form when completed, should be brought or sent to the Registry of Patents together with the rest of the application. Please note that the filing fee should be furnished within the period prescribed.
2. The relevant checkboxes as indicated in bold should be marked with a cross where applicable.
3. Enter the name and address of each applicant in the spaces provided in paragraph 3.  
Where the applicant is an individual
  - Names of individuals should be indicated in full and the surname or family name should be underlined.
  - The address of each individual should also be furnished in the space provided.
  - The checkbox for "For individual applicant" should be marked with a cross.Where the applicant is a body corporate
  - Bodies corporate should be designated by their corporate name and country of incorporation and, where appropriate, the state of incorporation within that country should be entered where provided.
  - The address of the body corporate should also be furnished in the space provided.
  - The checkbox for "For corporate applicant" should be marked with a cross.Where the applicant is a partnership
  - The details of all partners must be provided. The name of each partner should be indicated in full and the surname or family name should be underlined.
  - The address of each partner should also be furnished in the space provided.
  - The checkbox for "For others" should be marked with a cross and the name and address of the partnership should be indicated in the box provided.
4. In the field for "Country", please refer to the standard list of country codes made available by the Registry of Patents and enter the country code corresponding to the country in question.
5. The declaration of priority in paragraph 4 should state the date of the previous filing, the country in which it was made, and indicate the file number, if available. Where the application relied upon in an International Application or a regional patent application e.g. European patent application, one of the countries designated in that application [being one falling under section 17 of the Patents Act] should be identified and the country should be entered in the space provided.
6. Where the applicant or applicants is/are the sole inventor or the joint inventors, paragraph 5 should be completed by marking with a cross the 'YES' checkbox in the declaration (A) and the 'NO' checkbox in the alternative statement (B). Where this is not the case, the 'NO' checkbox in declaration (A) should be marked with a cross and a statement will be required to be filed on Patents Form 8.
7. When an application is made by virtue of section 20(3), 26(6) or 47(4), the appropriate section should be identified in paragraph 6 and the number of the earlier application or any patent granted thereon identified. Applicants proceeding under section 26(6) should identify which provision in rule 27 they are proceeding under. If the applicants are proceeding under rule 27(1)(a), they should also indicate the date on which the earlier application was amended.
8. Where the applicant wishes an earlier disclosure of the invention by him at an International Exhibition to be disregarded in accordance with section 14(4)(c), then the 'YES' checkbox at paragraph 7 should be marked with a cross. Otherwise, the 'NO' checkbox should be marked with a cross.
9. Where in disclosing the invention the application refers to one or more micro-organisms deposited with a depository authority under the Budapest Treaty, then the 'YES' checkbox at paragraph 8 should be marked with a cross. Otherwise, the 'NO' checkbox should be marked with a cross. Attention is also drawn to the Fourth Schedule of the Patents Rules.
10. Where an agent is appointed, the fields for "DETAILS OF AGENT" and "ADDRESS FOR SERVICE IN SINGAPORE" should be completed and they should be the same as those found in the corresponding Patents Form 41. In the event where no agent is appointed, the field for "ADDRESS FOR SERVICE IN SINGAPORE" should be completed, leaving the field for "DETAILS OF AGENT" blank.
11. In the event where an individual is appointed as an agent, the sub-field "Name" under "DETAILS OF AGENT" must be completed by entering the full name of the individual. The sub-field "Firm" may be left blank. In the event where a partnership/body corporate is appointed as an agent, the sub-field "Firm" under "DETAILS OF AGENT" must be completed by entering the name of the partnership/body corporate. The sub-field "Name" may be left blank.
12. Attention is drawn to sections 104 and 105 of the Patents Act, rules 90 and 105 of the Patents Rules, and the Patents (Patent Agents) Rules 2001.
13. Applicants resident in Singapore are reminded that if the Registry of Patents considers that an application contains information the publication of which might be prejudicial to the defence of Singapore or the safety of the public, it may prohibit or restrict its publication or communication. Any person resident in Singapore and wishing to apply for patent protection in other countries must first obtain permission from the Singapore Registry of Patents unless they have already applied for a patent for the same invention in Singapore. In the latter case, no application should be made overseas until at least 2 months after the application has been filed in Singapore, and unless no directions had been issued under section 33 by the Registrar or such directions have been revoked. Attention is drawn to sections 33 and 34 of the Patents Act.
14. If the space provided in the patents form is not enough, the additional information should be entered in the relevant continuation sheet. Please note that the continuation sheets need not be filed with the Registry of Patents if they are not used.



## A SYSTEM FOR CONNECTING BUOYANT MARINE BODIES

### FIELD OF INVENTION

The present invention relates to a system for connecting at least two buoyant marine bodies together and in particular although not solely to securing pontoons together in an end to end relationship.

### BACKGROUND

Floating marine bodies such as platforms, including pontoons or barges often need to be joined together to create a larger overall working surface such as to define a bridge or the like. Such platforms can also be utilised as a floating base for marine vehicle refilling or troop loading and to support helicopter operations or to isolate risky operations.

However the key technical challenge for constructing such joined floating platforms lies in the connector design which must address the difficulties relating to the relative motion between two platforms particularly in rough seas during the connection operation. The connector design must be able to sustain the dynamic forces as a result of the wave motion both during and once the connection has been established.

The relative vertical motion of two platforms can result in a relative movement between the two connecting units of more than 0.5m (when for example a platform is 40m long and 7m wide and operating in sea state three). In such conditions it would be very difficult for the operator to catch the right timing when the two platforms are in a condition where the connection units are aligned in order to connect the platforms together manually. It is also extremely dangerous to the operator working at the edges of the platform as these not only move up and down but can also knock together. Such movement may be sufficient to knock the operator from his/her feet and thereby potentially causing serious or fatal injuries.

Several designs have addressed various problems with connecting two platforms together and such designs have been mentioned for example in the patent specifications of US 4290382, US 3386117, US 4695184, JP 20203488 and US 5606929. The devices mentioned in these patent specifications all utilise a guided coupling pair which allows



for the two platforms to become increasingly aligned as the two platforms are brought together. However the coupling pairs are still in a rigid form and can cause significant impact loading on each other particularly when the engagement process is not complete.

It is accordingly an object of the present invention to provide a system for connecting at least two buoyant marine bodies together wherein during engagement, the severity of impact loading between the two bodies is able to be absorbed or which will at least provide the public with a useful choice.

### **BRIEF DESCRIPTION OF THE INVENTION**

In a first aspect the present invention consists in a system for connecting a first buoyant marine body to a second buoyant marine body in a side to side manner, said system comprising;

first male and female coupling members fixed respectively at the side of said first buoyant marine body and said second buoyant marine body

second male and female coupling members fixed respectively at the side of one or the other of said first and second marine bodies

said first male and female coupling members having an opposing relationship when the side of said first buoyant marine vessel is placed adjacent the side of said second buoyant marine vessel, the opposing relationship being such that as the first male and female coupling members are moved from an unengaged condition to a fully engaged condition by the movement of the first and second floating marine bodies towards each other in a first horizontal direction, the freedom of movement between the male coupling and the female coupling members, at least in the vertical direction, is decreases as they become vertically aligned



said second male and female coupling members having an opposing relationship when the side of said first buoyant marine body is placed adjacent the side of said second buoyant marine body, the opposing relationship being such that rigid coupling between said second male and female coupling members occurs, to prevent relative movement in at least the vertical direction, as the freedom of movement between the first male and female coupling members is or is proximate to being vertically aligned

the one or both of the first male and female coupling member being of a resiliently flexible nature

and securing means to be attached to said first and said second buoyant marine body to selectively prevent separation in said first horizontal direction of said first and second male and female coupling members.

Preferably the first male and female coupling members when moved from an unengaged condition to a fully engaged condition by the movement of the first and second buoyant marine bodies towards each other, the freedom of movement of the first male coupling member within the female coupling member in a horizontal direction lateral to the first horizontal direction is also decreased.

Preferably said first female coupling is a recess which includes an upper and lower substantially horizontally extending inwardly facing contact regions which define the limits of vertical movement of the first male coupling member as these are in a non-unengaged condition.

Preferably the first male coupling member includes upper and lower substantially outwardly facing and horizontally extending contact regions, presented to engage with respective to upper and lower contact regions of the first female coupling member, said upper and lower regions of the first male coupling member, when viewed in a horizontal direction lateral to said first horizontal direction, becoming progressively more proximate

to the upper and lower regions of said first female coupling member as the distance between said first and second buoyant bodies decreases.

Preferably the upper and lower contact regions of the first male coupling member are defined by surface of a configuration such they are in simultaneous contact with the respective upper and lower contact regions of the first female coupling member when in the fully engaged condition.

Preferably the first male coupling member is of an exterior shape which, in a vertical cross section and substantially parallel to the first horizontal direction, is substantially "D" shaped with the base thereof positioned proximate most to said first buoyant body and extending substantially vertically.

Preferably the upper and lower regions of the first male coupling member with which the upper and lower regions of the first female coupling member are to respectively contact, is tapered (whether curved or linearly) when viewed in a horizontal direction laterally to the first horizontal direction, said taper being such as to decrease the vertical clearance between the first male coupling member and first female coupling pair as it approaches the fully engaged condition.

Preferably said first male coupling member includes lateral surfaces which are substantially vertical and angled relative to the first horizontal direction to define a tapered configuration of the first male coupling member when viewed in plan view, the larger width portion thereof being proximate most the first buoyant marine body.

Preferably the first female coupling includes two opposing lateral guide surfaces which extend substantially vertically and are angled relative to the first horizontal direction to define a tapered configuration with the mouth opening between said two opposing surfaces being wider than the base width between said two opposing surfaces.

Preferably the lateral surfaces of the first male coupling member can be guided by the two opposing lateral guide surfaces when travelling from the unengaged condition to the fully engaged condition and to become both engaged with the two opposing lateral guide surfaces when in the fully engaged condition.

Preferably second male coupling member protrudes (in the first horizontal direction) less than and preferably less than half the distance from its respective first or second buoyant marine body than the distance that the first male coupling protrudes from the first buoyant marine body.

Preferably the depth (in the first horizontal direction) of extension of said second male coupling member into said second female coupling member is less than the depth (in the first horizontal direction) of extension of said first male coupling member into said first female coupling member.

Preferably said first mentioned depth is less than half said second mentioned depth.

Preferably said first mentioned depth is less than one third said second mentioned depth.

Preferably said first mentioned depth is less than one quarter said second mentioned depth.

Preferably said the side of said first buoyant marine body at which said first male coupling member is positioned is the stern side thereof and the side of said second buoyant marine body at which said first female coupling member is positioned, is the bow side thereof.

Preferably said the side of said first buoyant marine body at which said first male coupling member is positioned is the port side thereof and the side of said second buoyant marine body at which said first female coupling member is positioned, is the starboard side thereof.

Preferably said the side of said first buoyant marine body at which said first male coupling member is positioned is the stern side or bow side thereof and the side of said second buoyant marine body at which said first female coupling member is positioned, is the port or starboard side thereof.

Preferably the sides of said first and second buoyant marine bodies are substantially straight sides (when viewed in plan view).

Preferably said first buoyant marine body has fixed thereto at least one first male coupling member and at least two of either said second male or female coupling members to at least one side thereof.

Preferably said first buoyant marine body also includes a said first female coupling member to engage with a corresponding said first male coupling member of said second buoyant marine body.

Preferably said first buoyant marine body has fixed thereto a pair of second male coupling members and a pair of second female coupling members to at least one side thereof.

Preferably each of said pair are positioned at each end (horizontal) of a respective first male and female coupling members.

Preferably said buoyant marine bodies are barges.

Preferably said buoyant marine bodies are pontoons.

In a second aspect the present invention consists in a buoyant marine body system for the creation of a flexible in configuration floating marine structure, said pontoon system

comprising of a plurality of said pontoons each incorporating the system for securing as hereinbefore described.

Preferably the system for securing is identical for at least two of said pontoons of said pontoon system.

Preferably the system for securing is identical for all of said pontoons of said pontoon system.

Preferably the system for securing is provided at the bow and stern sides of each pontoon of said pontoon system to allow for end on end engagement of at least two pontoons.

In a further aspect the present invention consists in a coupling for connecting two buoyant marine bodies together in a side to side relationship, said coupling comprising

a first male coupling member fixed and protruding at the side of a first of said two buoyant marine bodies

a first female coupling member fixed at the side of a second of said two buoyant marine bodies said female coupling member being a horizontally extending channel having an opening through which said male coupling member can move to in a horizontal direction to become engaged therewith

said first male and female coupling members positioned to so that when in full engagement said first and second buoyant marine bodies are in a side by side relationship and relative vertical movement is limited by such engagement ,

a second male coupling member fixed and protruding at the side of one of said first or second of said two buoyant marine bodies

a second female coupling member fixed at the side of the other of said first or second of said two buoyant marine bodies to which said second male coupling member is fixed said second female coupling member being a recess having an opening via through which said male coupling member can move to in a horizontal direction once the first male and female coupling members approach a full engagement and to become engaged with each other to rigidly prevent movement relative to each other in at least a vertical direction,

the relationship between said first male and female coupling members being such that a graduated and reducing limitation in movement in the vertical direction occurs as the two buoyant marine bodies move closer to each other, at least one of said first male and female coupling members being of a resiliently flexible nature

and wherein fastening means are provided to hold said two buoyant marine bodies together when said first and second male and female coupling members are engaged.

his invention may also be said broadly to consist in the parts, elements and features referred to or indicated in the specification of the application, individually or collectively, and any or all combinations of any two or more of said parts, elements or features, and where specific integers are mentioned herein which have known equivalents in the art to which this invention relates, such known equivalents are deemed to be incorporated herein as if individually set forth.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

Figure 1 is a perspective view of part of a pontoon showing in detail the features of one side of the pontoon which has been adapted for interconnection with a substantially complimentary shaped side of a second pontoon (not shown),

Figures 2A-2D illustrate a side view of the complimentary shaped regions of two pontoons in the process from moving from an unengaged condition to an engaged condition.

**Figures 3A-3C** illustrate a plan view of the end regions of two pontoons and their movement laterally from an unengaged condition to an engaged condition,

**Figure 4** illustrates a plan view of two pontoons in an unengaged condition and wherein a rope or cable may be used to draw the two pontoons together,

**Figure 5** is a side view of an end region of a pontoon,

**Figure 6** is a plan view of an alternative configuration of the end of a pontoon,

**Figure 7** is a side view of an end region of a pontoon in an alternative configuration,

**Figure 8** is a side view of an end region of two pontoons in an alternative configuration,

**Figure 9** is a view of a series of pontoons connected side to side in an end on end relationship to for a bridge from shore to shore, and

**Figure 10** is a view of pontoons connected sided to side in both on end on end relationship and port to starboard side relationship, showing an application for such a system to create a working platform adjacent a ship.

## **DETAILED DESCRIPTION OF THE INVENTION**

With reference to **Figure 1** there is shown a buoyant marine body such as a pontoon 1 which has provided at, at least one side thereof, features for the engaging the pontoon 1 with a similar or like pontoon. The pontoon 1 may also be a barge, platform or other buoyant marine body or vessel and which is engageable to like bodies or vessels to form a greater overall floating arrangement. By way of example, pontoons in military applications may be used to form a bridge over a body of water. Likewise pontoons may be joined together and be positioned adjacent a vessel for the purposes of establishing a working surface which is more proximate to the water level adjacent a larger vessel as show in figure 10. Other applications include breakwater construction, ship to ship bridging, ship to shore bridging, a marine jetty and to provide the floatation pontoons for fish farm enclosure.

In a usual form such a pontoon will be of a square or rectangular plan shape and will provide four sides which may for example be considered a bow and stern side and

port and starboard side. The present invention is not limited to the provision of the securing features at only one side of the pontoon and indeed such may be provided at any side or any number of the sides. In the application where the pontoons are used for defining a bridge structure, the bridge is normally defined by the positioning of pontoons in a bow to stern manner and hence in this form it will the shorter length bow and stern sides of the pontoon which are provided with the securing features.

The pontoons of such a system are preferably substantially identical and the securing features provided at such opposing ends are substantially complimentary shaped. A securing feature is provided at at least one side of a pontoon and comprises a first male coupling member 2 which is to engage with a female coupling member 3 of an adjacent pontoon. Two pontoons when floating on water have the first male and female coupling members 2, 3 positioned at a height which is substantially the same relative to the waterline. With reference to Figures 2A-2D, the two pontoons may move relative to each other in for example the Z direction as a result of wave action and the first male and female coupling members can move in a vertical direction (Z direction) relative to each other when they are not aligned as for example shown in Figure 2A. Coupling of the first male coupling member 2 with the first female coupling member 3 occurs as the two pontoons are brought more proximate to each other in a first horizontal direction (Y direction).

The first male and female coupling members are for example provided on a vertical side face of each of the first and second pontoons and as the pontoons are brought more proximate to each other, the first male coupling member 2 will at least in part become located within the first female coupling member 3. As the pontoons are brought more proximate to each other the first male member 2 will move to become engaged with the female member to prevent relative movement in the Z direction. As the pontoons may be assembled in an end-end relationship in sea states where relative movement between the two pontoons occurs, the relationship between the first male and female coupling members is such that a guiding engagement occurs. At the initial stages of engagement, the fit between the first male and female coupling members is relatively loose and the pontoons can move in a limited manner in the Z direction relative to each other. The first female coupling member 3 may include a mouth opening and a tapered recess which



tapers inwardly as it progresses downwardly towards the bottom of the recess as for example shown in Figure 1. Its preferred shape is "V" or "U" shaped. Alternatively or in addition, the first male coupling member 2 is of a tapered nature. With reference to Figure 2A, it is of a non linear taper and indeed is preferably semi circular (or "D" shaped) when viewed from the side in a horizontal direction (X axis direction) which is lateral to the direction of horizontal engagement (Y direction).

Significant movement between the two pontoons is induced by variation in the waterline level as result of the wave action (and a relative movement of the two pontoons hence being in the Z direction). The taper is provided to decrease the degree of freedom of movement in the Z direction between the two pontoons during the engagement process as it moves to a stage where the two pontoons are fully engaged. With reference to Figure 6 which is a plan view of a pontoon, it can also be seen that a taper in the X-Y plane may be provide at the ends of the first male coupling members 3. Such a taper is provided to decrease the degree of freedom of movement in the X direction (horizontal and in a direction lateral to the engagement direction (Y) of the two pontoons) and to guide any lateral miss alignment of the two pontoons in the X direction (see fig 3a-3c).

A taper of the first female coupling member 3 which corresponds to the taper of the first male coupling member in the Z-Y direction may be provided. When the two pontoons are in a fully engaged condition, the first male coupling member is located securely within the first female coupling member and any significant relative movement therebetween at least in the X direction and preferably also in the Z direction between the two pontoons is thereby prevented or at least significantly reduced.

The first male and female coupling members may be of a complimentary shape. In the preferred form the first male coupling member is substantially D shaped in a vertical cross section taken parallel to the direction of engagement (Y direction). The male coupling member is preferably made of a resiliently flexible material such as a rubber or plastics material. Impact between the first and second pontoon is preferably absorbed by the first male coupling member as result of its material selection. The first male coupling member hence also acts as a fender during the coupling process. The first female coupling member may insted be flexible or both may be flexible. With reference to Figures 3A-3C, it can be seen that the first male coupling member 3 during the

engagement process can be positioned to fend between the first and second pontoons. When no correct alignment for complete engagement between the two pontoons is provided, the first male coupling member 2 will not be in alignment with the first female coupling member 3 and movement between the two pontoons which may create impact between the two pontoons is absorbed by the first male coupling member 2 to thereby lessen any impact damage between the two pontoons.

With reference to Figure 8, it can be seen that the female coupling member 3 need not necessarily be of a complimentary shape to the male coupling member 2. The male coupling member (being preferably of a D shaped vertical cross section) can move into the recess 4 of the first female coupling member 3 and be guided by substantially horizontally extending upper and lower edges or surfaces 5, 6 at the mouth opening of the recess 4 of the first female coupling member 3.

In the most preferred form the first male and female coupling members 2, 3 are of an elongate nature (extending in the X direction) as for example shown in Figure 1. By being of an elongate nature, motion in not just the Z direction between the two pontoons can be absorbed by the fender but also a roll of the two pontoons about the Y axis can be absorbed.

In the most preferred form each pontoon is preferably provided with at least two first male/female coupling members spaced apart in the X direction. With reference to Figure 1 it can be seen that at, at least one side of the pontoon there is provided a first male coupling member 2 and a first female coupling member 3. Each of these is to engage with a complementary first female and first male coupling member of an adjacent pontoon. Although it is preferred that one first male and one first female coupling member is provided at at least one side of a pontoon, it may merely be one first male coupling member that is provided or perhaps one or two first male coupling members. Indeed a plurality of first male coupling members or first male/first female coupling members may be provided along at least one side of the pontoon, particularly if the sides are relatively long.

The first male and first female coupling members may be provided above or below the waterline of the pontoons.

The two pontoons may be brought more proximate to each other by the use of a cable or rope or the like which may be rigged as for example shown in Figure 4. A rope is adjustable in length by a winch 6 to draw the two pontoons together. The rope may be provided at deck level (above the position of the first male and preferably second and female coupling members) and by the winding of the winch can draw the two pontoons (in the Y direction closer together). This rope may also to some extent create an alignment in the X direction between the two pontoons.

The same side or sides of the pontoon from which the first male and/or female coupling members are provided, also include a second male or female coupling member(s) 7,8. A second male coupling member 7 may for example be provided at the same side as the first male coupling member 3 as for example shown in Figure 1. The second male coupling member 7 protrudes from the side of the pontoon in a manner to be engageable with a second female coupling member 8 of an adjacent pontoon. The second female coupling member 8 is a rebate or recess with which the second male coupling member 7 can engage. Engagement occurs by the movement of the pontoons more proximate to each other along the Y axis. The second male coupling member 7 and second female coupling member 8 are of a nature such that when they are fully engaged, no movement between the two pontoons in at least the Z direction (and preferably also the X direction) can occur. In fact the shear loading that is created by the differential forces applied to the pontoons by the sea state in both the Z direction and X direction are carried by the second male and female coupling members. The rebate of the second female coupling member 8 is substantially of a complimentary shape to the shape of the second male coupling member 7. When the pontoons, in the Y direction, are in an engaged condition, the second male coupling member 7 locates without any significant freedom of movement in the X and Z directions in the second female coupling member 8.

The protrusion of the second male coupling member 7 from the side of a pontoon is to a degree less and preferably significantly less than the protrusion of the first male coupling member 2 from the same side of the pontoon or of a mating pontoon. The engagement process of the second male and female coupling members hence occurs at a stage where a coupling between the first male and female coupling members has been advanced to a significant stage. Hence during engagement of the first male and female

coupling members, no contact between the second male and female coupling members occurs at least for a significant distance of travel of the two pontoons towards each other. Contact of the second male and female coupling members is made as the first male and female coupling members approach a fully engaged condition. The second male and female coupling members then become engaged with each other. Although preferably such engagement is also a graduated engagement in that at the initial stages of coupling a degree of freedom of movement if allowed, the distance of travel required for a full engagement to occur of the second male and female coupling members is significantly less than compared to that for the first male and female coupling members. The second male coupling member 7 is preferably made of a rigid material such as a metal. The relationship between the second male and female coupling members when fully engaged is a rigid relationship. The engagement of the second male and female coupling members does not occur until the two pontoons are substantially proximate to their fully engaged position along the Y axis direction. As the first male and female coupling members are at such point to be engaged with each other, the relative movement between the two pontoons at least in the Z direction and preferably also in the X direction has been significantly reduced by the first male and female coupling members. Accordingly relative movement between the second male and female coupling members along the X and Z directions is also significantly reduced and the second male and female coupling members are then in a substantial alignment such that continued movement of the two pontoons closer together will engage the second male and female coupling members without significant impact occurring therebetween. A slight taper may like the first male coupling member, be provided on the second male coupling member 7 such that the engagement of the second male and female coupling members is also a guided engagement.

A pontoon may be provided with at least one second male coupling member 7 and the second female coupling member provided on an adjacent pontoon. However there is preferably provided two second male coupling members on a pontoon to be engaged with corresponding two second female coupling members on an adjacent pontoon. In the most preferred form, there are provided two second male coupling members 7 adjacent the

longitudinal ends of the first male coupling member 2. This is for example shown in Figure 1.

In the arrangement shown in Figure 1 one first male and one first female coupling members are provided positioned adjacent each other and preferably axially aligned along the X direction axis, a pair of female second coupling members may be provided adjacent the longitudinal ends of the first female coupling members and a pair of second male coupling members may be provided at the longitudinal ends of the first male coupling member. It will be appreciated that conversely the first male coupling member 2 may be flank by two second female coupling members or a combination of such.

Once the pontoons are in an engaged condition, they may be held in such a relationship to prevent movement apart from each other in the Y direction, by the use of fastening means 10. Such fastening means can span between the two pontoons and engage the two pontoons axially together to thereby prevent relative movement of the two pontoons at least to a significant degree in the Y direction. The fastening means 10 hence will ensure that the first and second male and female coupling members do not separate from each other and are kept in an engaged condition such that they transmit any force differential between the two pontoons in the X and Z directions. Such fastening means may preferably be of a quick fit fastening means such that when alignment does occur between the two pontoons, the fastening means can operate relatively quickly to lock the two pontoons together. The faster is positioned above the first and second male and female coupling members. The faster could also be positioned in line or below the coupling members. Alternative fastening means may be used such a vacuum cup suction pads.

Although as mentioned it is preferred that the first male coupling member 2 is of a substantially D shaped cross section, it can be seen with reference to Figure 7 that the cross section may be of a linear taper and may include a truncation at its protruding most end.

**CLAIMS**

1. A system for connecting a first buoyant marine body to a second buoyant marine body in a side to side manner, said system comprising;

first male and female coupling members fixed respectively at the side of said first buoyant marine body and said second buoyant marine body

second male and female coupling members fixed respectively at the side of one or the other of said first and second marine bodies

said first male and female coupling members having an opposing relationship when the side of said first buoyant marine vessel is placed adjacent the side of said second buoyant marine vessel, the opposing relationship being such that as the first male and female coupling members are moved from an unengaged condition to a fully engaged condition by the movement of the first and second floating marine bodies towards each other in a first horizontal direction, the freedom of movement between the male coupling and the female coupling members, at least in the vertical direction, is decreases as they become vertically aligned

said second male and female coupling members having an opposing relationship when the side of said first buoyant marine body is placed adjacent the side of said second buoyant marine body, the opposing relationship being such that rigid coupling between said second male and female coupling members occurs, to prevent relative movement in at least the vertical direction, as the freedom of movement between the first male and female coupling members is or is proximate to being vertically aligned

the one or both of the first male and female coupling member being of a resiliently flexible nature

and securing means to be attached to said first and said second buoyant marine body to selectively prevent separation in said first horizontal direction of said first and second male and female coupling members.

2. A system as claimed in claim 1 wherein the first male and female coupling members when moved from an unengaged condition to a fully engaged condition by the movement of the first and second buoyant marine bodies towards each other, the freedom of movement of the first male coupling member within the female coupling member in a horizontal direction lateral to the first horizontal direction is also decreased.
3. A system as claimed in claims 1 or 2 wherein said first female coupling is a recess which includes an upper and lower substantially horizontally extending inwardly facing contact regions which define the limits of vertical movement of the first male coupling member as these are in a non-unengaged condition.
4. A system as claimed in claim 3 wherein the first male coupling member includes upper and lower substantially outwardly facing and horizontally extending contact regions, presented to engage with respective to upper and lower contact regions of the first female coupling member, said upper and lower regions of the first male coupling member, when viewed in a horizontal direction lateral to said first horizontal direction, becoming progressively more proximate to the upper and lower regions of said first female coupling member as the distance between said first and second buoyant bodies decreases.
5. A system as claimed in claim 4 wherein the upper and lower contact regions of the first male coupling member are defined by surface of a configuration such they are in simultaneous contact with the respective upper and lower contact regions of the first female coupling member when in the fully engaged condition.

6. A system as claimed in any one of claims 1 to 5 wherein the first male coupling member is of an exterior shape which, in a vertical cross section and substantially parallel to the first horizontal direction, is substantially "D" shaped with the base thereof positioned proximate most to said first buoyant body and extending substantially vertically.
7. A system as claimed in any one of claims 4 to 6 wherein the upper and lower regions of the first male coupling member with which the upper and lower regions of the first female coupling member are to respectively contact, is tapered (whether curved or linearly) when viewed in a horizontal direction laterally to the first horizontal direction, said taper being such as to decrease the vertical clearance between the first male coupling member and first female coupling pair as it approaches the fully engaged condition.
8. A system as claimed in any one of claims 1 to 7 wherein said first male coupling member includes lateral surfaces which are substantially vertical and angled relative to the first horizontal direction to define a tapered configuration of the first male coupling member when viewed in plan view, the larger width portion thereof being proximate most the first buoyant marine body.
9. A system as claimed in claims any one of 1 to 8 wherein the first female coupling includes two opposing lateral guide surfaces which extend substantially vertically and are angled relative to the first horizontal direction to define a tapered configuration with the mouth opening between said two opposing surfaces being wider than the base width between said two opposing surfaces.
10. A system as claimed in claims 8 or 9 wherein the lateral surfaces of the first male coupling member can be guided by the two opposing lateral guide surfaces when travelling from the unengaged condition to the fully engaged condition and to become both engaged with the two opposing lateral guide surfaces when in the fully engaged condition.



11. A system as claimed in claims any one of 1 to 8 wherein second male coupling member protrudes (in the first horizontal direction) less than and preferably less than half the distance from its respective first or second buoyant marine body than the distance that the first male coupling protrudes from the first buoyant marine body.
12. A system as claimed in claims any one of 1 to 8 wherein the depth (in the first horizontal direction) of extension of said second male coupling member into said second female coupling member is less than the depth (in the first horizontal direction) of extension of said first male coupling member into said first female coupling member.
13. A system as claimed in claim 12 wherein said first mentioned depth is less than half said second mentioned depth.
14. A system as claimed in claim 12 wherein said first mentioned depth is less than one third said second mentioned depth.
15. A system as claimed in claim 12 wherein said first mentioned depth is less than one quarter said second mentioned depth.
16. A system as claimed in any one of claims 1 to 15 wherein said the side of said first buoyant marine body at which said first male coupling member is positioned is the stern side thereof and the side of said second buoyant marine body at which said first female coupling member is positioned, is the bow side thereof.
17. A system as claimed in any one of claims 1 to 15 wherein said the side of said first buoyant marine body at which said first male coupling member is positioned is the port side thereof and the side of said second buoyant marine body at which said first female coupling member is positioned, is the starboard side thereof.

18. A system as claimed in any one of claims 1 to 15 wherein said the side of said first buoyant marine body at which said first male coupling member is positioned is the stern side or bow side thereof and the side of said second buoyant marine body at which said first female coupling member is positioned, is the port or starboard side thereof.
19. A system as claimed in any one of claims 1 to 18 wherein the sides of said first and second buoyant marine bodies are substantially straight sides (when viewed in plan view).
20. A system as claimed in any one of claims 1 to 19 wherein said first buoyant marine body has fixed thereto at least one first male coupling member and at least two of either said second male or female coupling members to at least one side thereof.
21. A system as claimed in claim 20 wherein said first buoyant marine body also includes a said first female coupling member to engage with a corresponding said first male coupling member of said second buoyant marine body.
22. A system as claimed in claim 21 wherein said first buoyant marine body has fixed thereto a pair of second male coupling members and a pair of second female coupling members to at least one side thereof.
23. A system as claimed in claim 22 wherein each of said pair are positioned at each end (horizontal) of a respective first male and female coupling members.
24. A system as claimed in any one of claims 1 to 23 wherein said buoyant marine bodies are barges.
25. A system as claimed in any one of claims 1 to 24 wherein said buoyant marine bodies are pontoons.

26. A buoyant marine body system for the creation of a flexible in configuration floating marine structure, said pontoon system comprising of a plurality of said pontoons each incorporating the system for securing as claimed in anyone of the preceding claims.
27. A system as claimed in claim 26 wherein the system for securing is identical for at least two of said pontoons of said pontoon system.
28. A system as claimed in claim 26 or 27 wherein the system for securing is identical for all of said pontoons of said pontoon system.
29. A system as claimed in any one of claims 26 to 28 wherein the system for securing is provided at the bow and stern sides of each pontoon of said pontoon system to allow for end on end engagement of at least two pontoons.
30. A coupling for connecting two buoyant marine bodies together in a side to side relationship, said coupling comprising
- a first male coupling member fixed and protruding at the side of a first of said two buoyant marine bodies
  - a first female coupling member fixed at the side of a second of said two buoyant marine bodies said female coupling member being a horizontally extending channel having an opening through which said male coupling member can move to in a horizontal direction to become engaged therewith
  - said first male and female coupling members positioned to so that when in full engagement said first and second buoyant marine bodies are in a side by side relationship and relative vertical movement is limited by such engagement ,
  - a second male coupling member fixed and protruding at the side of one of said first or second of said two buoyant marine bodies

a second female coupling member fixed at the side of the other of said first or second of said two buoyant marine bodies to which said second male coupling member is fixed said second female coupling member being a recess having an opening via through which said male coupling member can move to in a horizontal direction once the first male and female coupling members approach a full engagement and to become engaged with each other to rigidly prevent movement relative to each other is at least a vertical direction,

the relationship between said first male and female coupling members being such that a graduated and reducing limitation in movement in the vertical direction occurs as the two buoyant marine bodies move closer to each other, as least one of said first male and female coupling members being of a resiliently flexible nature

and wherein fastening means are provided to hold said two buoyant marine bodies together when said first and second male and female coupling members are engaged.

**ABSTRACT**

A system for connecting a two buoyant marine body in a side to side manner, the system comprising first male and female coupling members fixed to the side of a first and second marine body and Second male and female coupling members which are fixed to the side of a first and second marine body. The first male and female coupling members have an opposing relationship and can be moved from an unengaged condition to a fully engaged condition by the movement of the first and second floating marine bodies towards each other in a first horizontal direction. The freedom of movement between the male coupling and the female coupling members, at least in the vertical direction, is decreased as they become vertically aligned. Second male and female coupling members will create a rigid coupling to prevent relative movement in at least the vertical direction, as the freedom of movement between the first male and female coupling members is or is proximate to being vertically aligned. The first male coupling member is of a resiliently flexible nature and can take any impact loading between the two bodies. Securing means is included to attach the buoyant marine bodies together in a horizontal direction.



\*162162\*



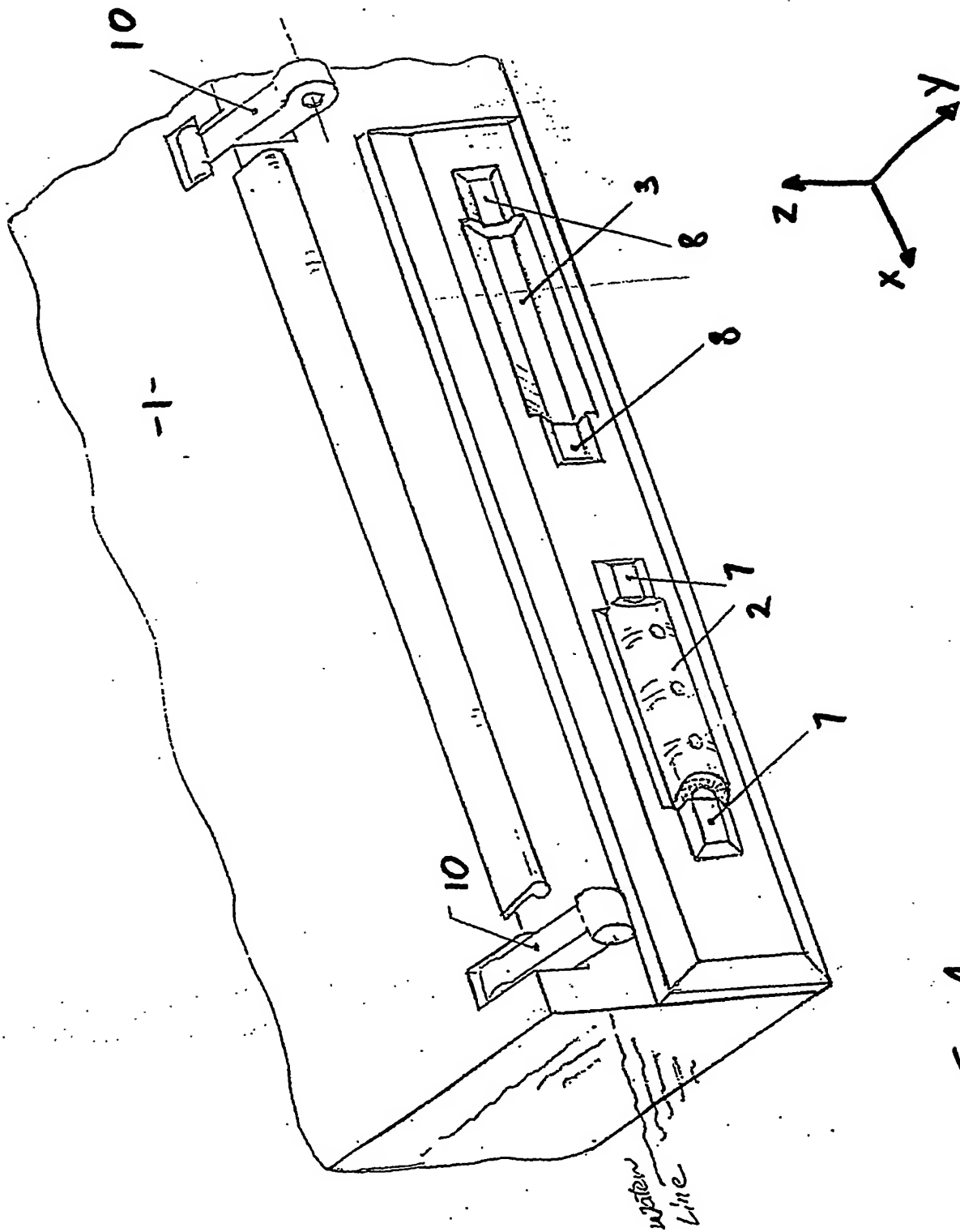
\*G00002\*



**\*G00002\***



**\*163163\***



Fiog

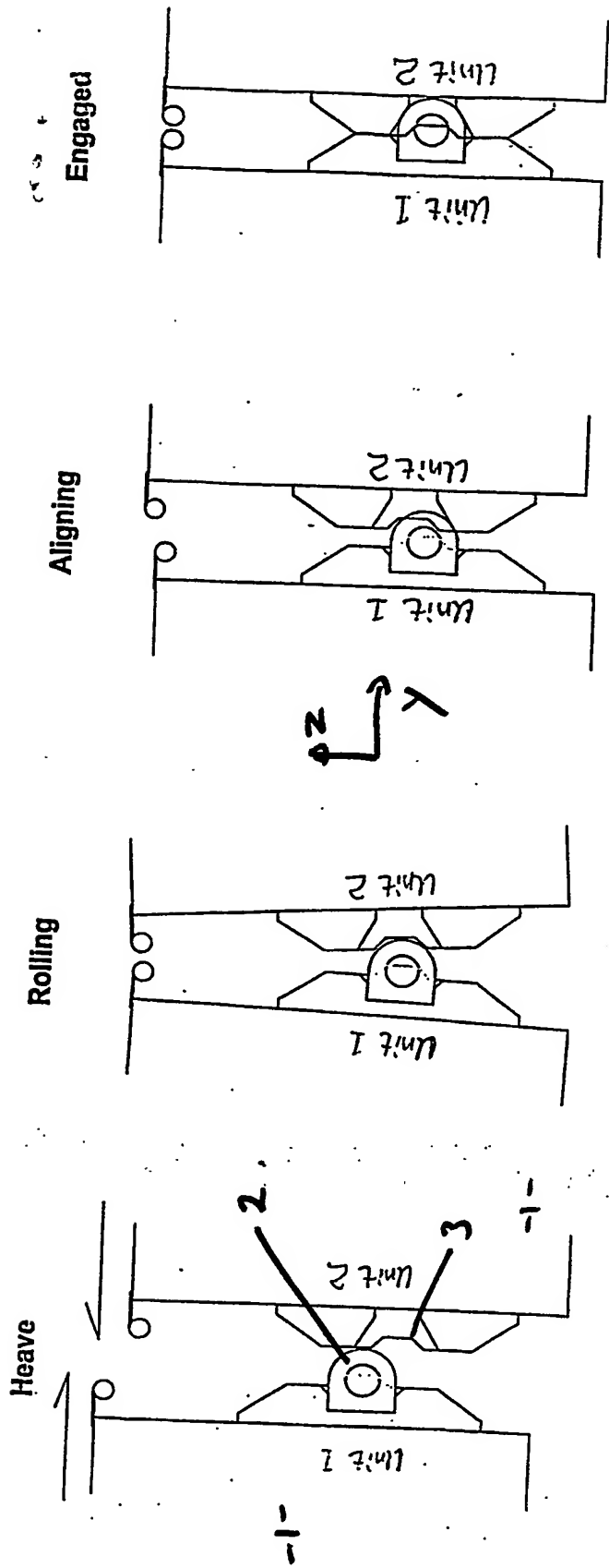


Fig 2a

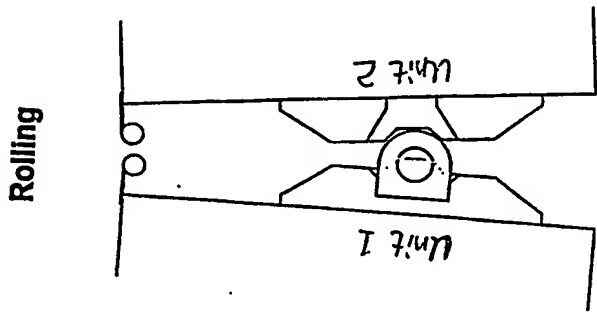


Fig 2b

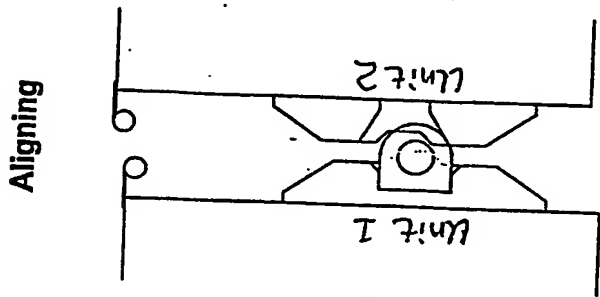
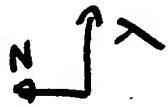


Fig 2c

Fig 2d

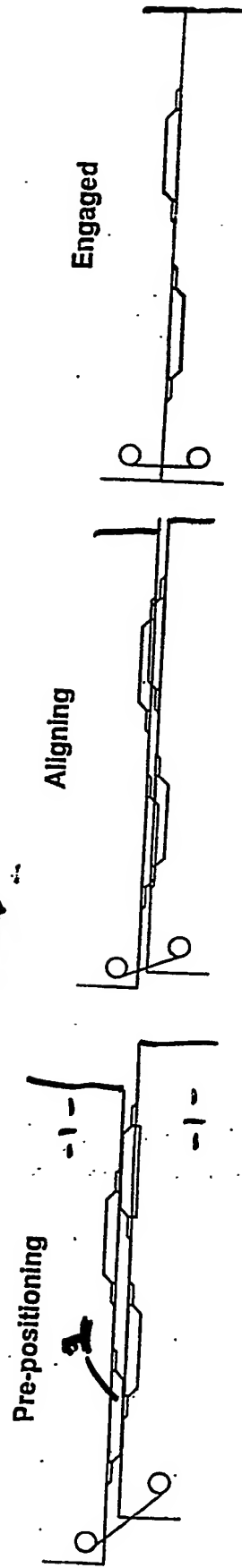


Fig 3a

Fig 3b

Fig 3c

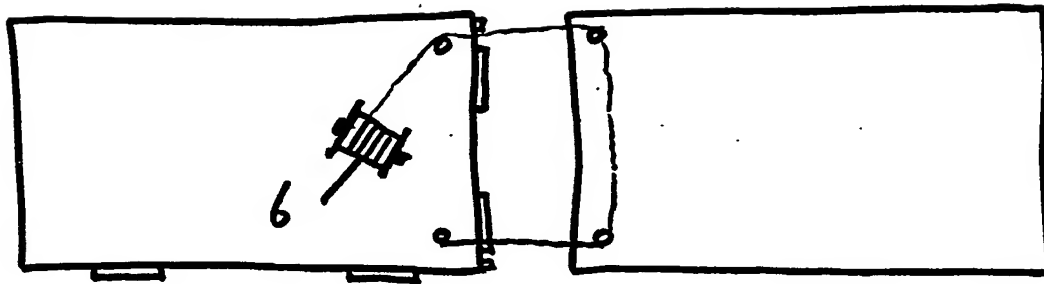


Fig 4

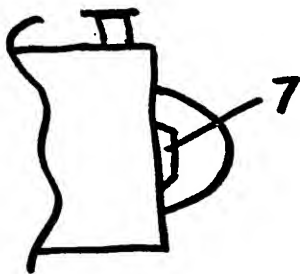


Fig 5

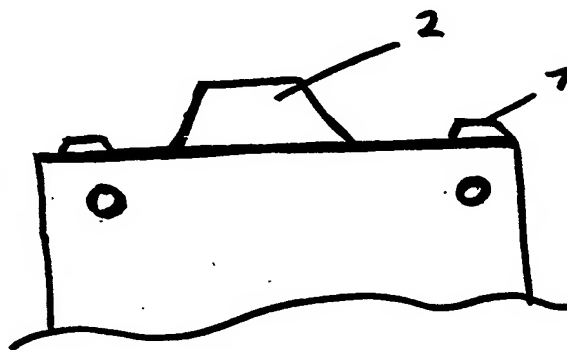


Fig 6

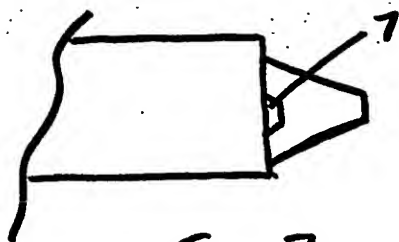


Fig 7

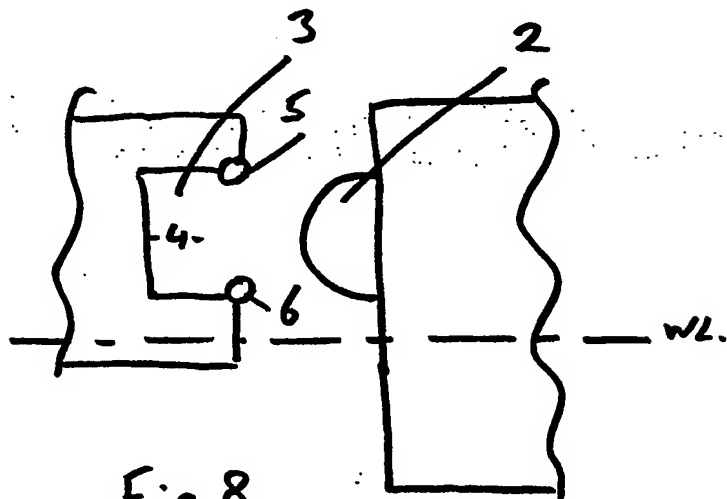


Fig 8



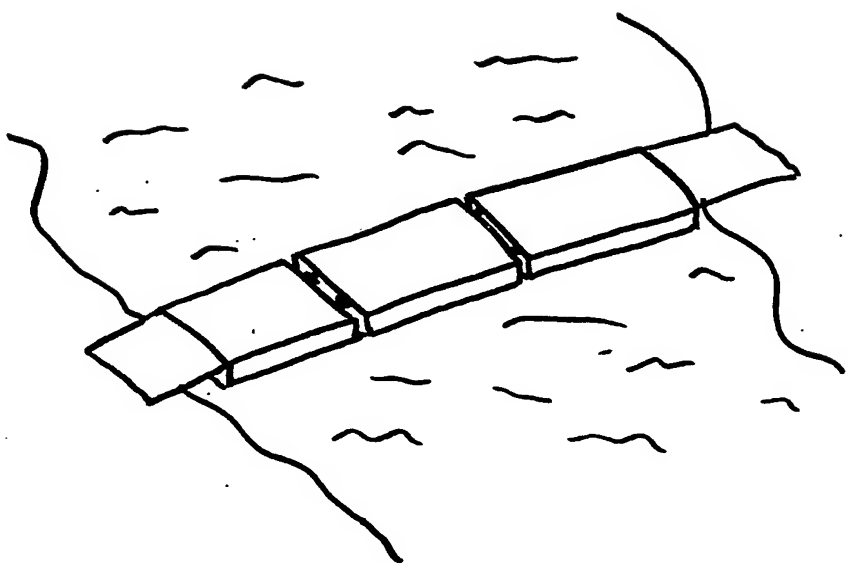


Fig. 9

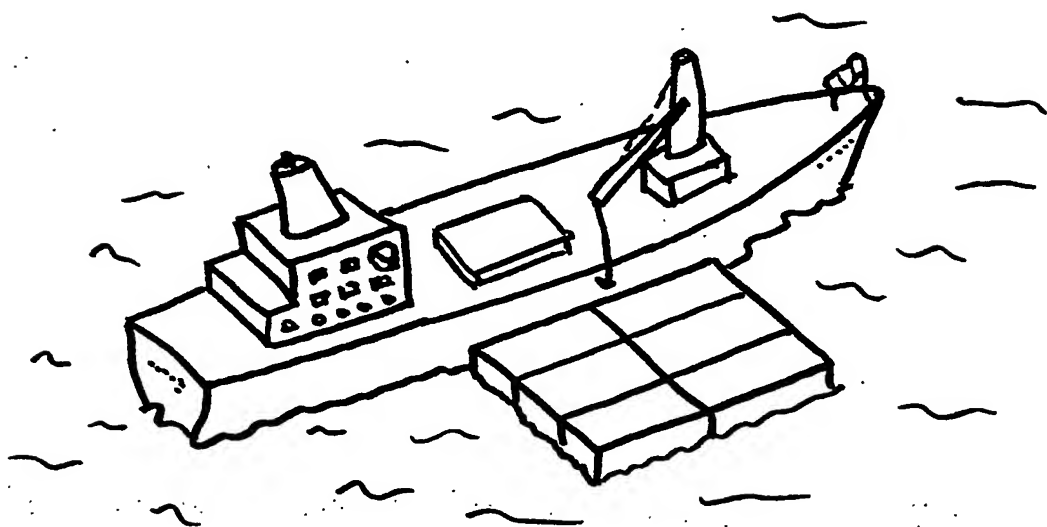


Fig. 10

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☒ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**